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fruitful activity in this field of research than there is at present. While we may not, therefore, blindly accept the conclusions of any critic, the summing up of the debate at any given point in its progress must prove of great value, especially when it is done with the skill and judgment displayed in Dr. Raeder's book.

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Symbolic Logic and Its Applications. By HUGH MACCOLL. London, Longmans, Green, & Co., 1906. — pp. vi, 141.

The Development of Symbolic Logic. By A. T. SHEARMAN. London, Williams & Norgate, 1906. — pp. xi, 242.

The former of these two works is an exposition of the author's system of symbolic logic. The latter is a general outline of the history of symbolic logic, "a critical-historical study of the logical calculus," as the sub-title of the works states. In Mr. MacColl's treatise a number of the chapters are reproductions of articles of his which appeared originally in *Mind* and the *Athenæum*. His system is given here, however, for the first time in its entirety. The fundamental characteristic of his system lies in his use of symbols to represent propositions rather than classes. His unit of thought is thus the judgment rather than the concept; and his point of view is that of implication rather than that of the inclusion and exclusion of related classes. In his insistence, however, upon the propositional representation as the sole method of logical symbolism, he fails utterly to appreciate the possibilities or the value of such systems as those of Boole, Venn, Jevons, and others. While not allowing the exclusive character which Mr. MacColl claims for his method of representation, one must nevertheless admit that, in making the proposition the unit of thought, he has brought the symbolic logic into line with the general theory of modern logic to-day. Mr. MacColl differs, again, from earlier systems in not employing the equation as the elemental mode of expressing the various judgment forms. He represents the subject of a proposition by a letter such as A, its predicate by the use of an exponent, and an adjectival qualification by a suffix.

Thus with the proposition, 'An experienced man is always confident,' he would represent 'man' by M, 'experienced' by e, and 'confident' by c. The stenographic symbol of the proposition would be, M_e^c. If a negative predicate is to be indicated, it is done by the *minus* sign attached to the exponent. Instead of employing the sign of equality, $=$, he substitutes for it the sign, $:$, which signifies the relation of implication. For instance, let k stand for 'knowledge,' and p for 'power'; then $k : p$ would signify — 'knowledge implies power.' Then there is also his syllogistic formula, — $(x : y)(y : z) : (x : z)$. This formula asserts that, 'If x implies y, and y implies z, then x implies z.' We have now before us the essential elements of his symbolical machinery. They admit naturally of indefinite explication, and complication as well, but this is his symbolism in the small at least.

Mr. MacColl's most original contribution, in the presentation of his system, is his so-called *calculus of limits*. This is illustrated at length in this volume.

In the course of his symbolical treatment of the subject, he touches upon general questions which are related immediately and essentially to the general theory of logic. In the limited space assigned to this review, I can mention but briefly in passing the most striking of these.

1. Instead of the simple categories of the true and the false, upon which all logical significance or value turns, Mr. MacColl introduces three additional categories which he insists must be reckoned with in any symbolic system of logic, namely: the certain, the impossible, and the variable. This is certainly a needless complication, and does not make for clearness or for definiteness of thought. The question of certainty or impossibility is one which naturally arises in the course of thought, but it is essentially a different question from the strictly logical one of the true and the false. Moreover, the idea of the true carries with it the implication of the certain according to the general dictum: 'Once true, always true.' The variable element in the statement of a truth, if any such exists, lies wholly in the difficulty of exact and adequate knowledge and the limitations in expressing the same. But when the truth is fully established as truth, all variable elements are eliminated. Indeed, the progress of thought in any field of research may be described as the process of eliminating the variable elements in the formulation of universal and necessary truth. Truth is revealed by the presence of this necessary element. It must be remembered that the general logic is the science of exact thought, and that exact thought may be expressed symbolically by the symbols 1 and 0, the 1 representing truth, and the 0 representing falsity. Any intermediate statements having an obviously variable character may be represented by the proper fractions lying between the limits of 0 and 1, that is, the sphere of probability, which is confessedly a sphere of tendencies at best and not of law or of constant behavior. The moment such a tendency is further qualified so that the variable element is eliminated, it admits of exact formulation and swings into the

orbit of the logic of determinate thought, which is expressed by an algebra wherein the values of x are 1 and 0 respectively. Mr. MacColl gives an illustration of what he is pleased to call a variable proposition in the following: 'Mrs. Brown is not at home.' He insists that this statement is true in some contexts, but not in others. "By a variable," he says, "I merely mean that the symbol, word, or collection of words, sometimes represents a truth and sometimes an untruth." Such a formal representation is, however, not a proposition; it is only the skeleton of a proposition. To say that the proposition, 'Mrs. Brown is not at home,' is true or false according as we state one definite time or an other in connection with it, is merely saying that it is only the blank form of a proposition to be made definite, and therefore in truth a proposition, by filling out the blank spaces with terms having a real worth and significance. Mr. MacColl could with as much propriety call a blank check negotiable paper. It is not a check until it is filled out and signed. It must be remembered that logic, even symbolic logic, does not deal with form without content. Even its most general expressions imply that the content, though not specifically expressed, must be regarded as having a constant and not a variable logical significance.

2. Mr. MacColl insists, and quite properly, upon the essentially hypothetical character of the syllogism, and urges that, when we say: 'Every A is B, and every B is C, therefore every A is C,' we really mean: 'If every A is B, and every B is C, then every A is C' (p. 47). This is all very well as far as it is the expression in exact terms of the underlying law of implication, but it will not do at all when we are face to face with a concrete situation and have to render a definite judgment as the result of our interpretation of the law of implication. Mr. MacColl states that, when we say P is true, *therefore*, Q is true, we really mean, If P is true, then Q is true (p. 48). I insist, however, that there are situations which a hypothetical never satisfactorily meets. The point often is, whether a P is true or not, and that being settled, the implication that Q is true also follows necessarily and there is a force to the connecting word *therefore*. For instance, let us take an illustration which the author himself gives to substantiate his contention (pp. 48, 49). "Suppose a general whose mind, during his past university days, had been over-imbued with the traditional logic were in war time to say, in speaking of an untried and possibly innocent prisoner, 'He is a spy, therefore he must be shot,' and that this order were carried out to the letter. Could he afterwards exculpate himself by saying that it was all an

unfortunate mistake, due to the deplorable ignorance of his subordinates; that if these had, like him, received the inestimable advantages of a logical education, they would have known at once that what he really meant was, '*If* he is a spy, he must be shot'? The argument in defense of the traditional wording of the syllogism is exactly parallel." Now, in reference to this illustration, I take it that, before the fact of his being a spy or not had been established, the general or any one else could only state the situation hypothetically, "If he is a spy, he must be shot." But when the evidence is all in, suppose the general continues to reiterate indefinitely, "If he is a spy, he must be shot"; and when asked "But what are we to do with the prisoner?" his only reply continues to be, "If he is a spy, he must be shot." Then I say that the general is talking sheer nonsense. The logic of the situation demands that the general assert that the man is a spy and *therefore* he must be shot, or that he is not a spy, and *therefore* need not be shot. The potential of logical implication always rests upon a hypothetical relation. The logic of an actual situation or relation cannot remain merely hypothetical.

3. There is also a discussion at some length concerning the traditional treatment of distribution of terms in a syllogism. Mr. MacColl attempts to prove that the distinction between a distributed and undistributed term is misleading. He says: "The leading syllogism *Barbara*, must hold good whatever values (or meanings) we give to its constituents X, Y, Z. It must therefore hold good when X, Y, Z are synonyms, and therefore all denote *the same class*. Now consider one of the premises, say, 'all x is y.' Here, by the usual logical convention, the class X is said to be 'distributed' and the class Y undistributed. But when X and Y are synonyms, they denote the *same class*, so that the same class may at the same time and in the same proposition be both '*distributed*' and '*undistributed*.' Does not this sound like a contradiction?" No, most certainly not, if the significance of the terms 'distributed' and 'undistributed' be clearly understood. To say that a term is distributed means that from the very form of the proposition it is rendered explicitly determinate as a universal; to say that a term is undistributed does not, however, mean that the form of the proposition renders it explicitly determinate as a particular. The universal affirmative proposition, 'all X is Y,' does not by any means determine the predicate as particular; it merely leaves it indeterminate. The subject is necessarily universal; the predicate term is not necessarily universal. Mr. MacColl throughout labors under the mistaken idea that the form of a proposition is entirely

independent of its material content. He forgets again and again that mere form without any indication of content may give you certain information; but that, when you fill out the symbols with actual significant terms, your information concerning the meaning and scope of that proposition must be materially changed, and the form of a proposition will itself vary as the significance of its terms varies. The one is so essentially the function of the other that to regard the one apart from its relation to the other is a separation needlessly artificial and misleading.

4. Again, the author objects that the traditional rules of the syllogism regarding the undistributed middle and the illicit process of the major or the minor terms do not hold invariably in the symbolic logic. He cites as an exception the following inference which is valid and nevertheless follows from an undistributed middle.

"If every *X* is *Y*, and every *Z* is also *Y*, then something which is not *X* is not *Z*." This reasoning, however, while in the form of syllogism, is not a syllogism; for in addition to the three terms *X*, *Y*, *Z*, which constitute the syllogism proper, there have been introduced two additional terms, the contradictory of *X* and the contradictory of *Z*. Mr. MacColl's strictures upon the syllogism are based throughout his discussion upon a mistaken idea of what a syllogism is. The syllogism has three terms and only three terms. There are extra-syllogistic forms of reasoning in the general guise of a syllogistic form, but they are not syllogisms. Mr. MacColl's criticisms are quite correct concerning these pseudo-syllogisms, but they do not in the remotest manner touch the syllogism in its proper and true form.

Unlike Mr. MacColl's work, that of Mr. Shearman does not attempt the formulation of any system. His purpose is to indicate the fundamental principles of symbolic logic and their historical development. He traces the line of development from Boole to the most recent contributions of Frege, Peano, and Russell. Mr. Shearman's treatment of the subject is determined by his general postulate that there is one logical calculus and that all the several authors on the subject have been working toward one and the same end. Mr. Shearman's account of the principles of the symbolic logic is clear and illuminating. His work serves the purpose of an excellent orientation of the subject.

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